# Internet in Space with TDRSS

## Operating Missions as Nodes on the Internet (OMNI)

**http://ipinspace.gsfc.nasa.gov/**

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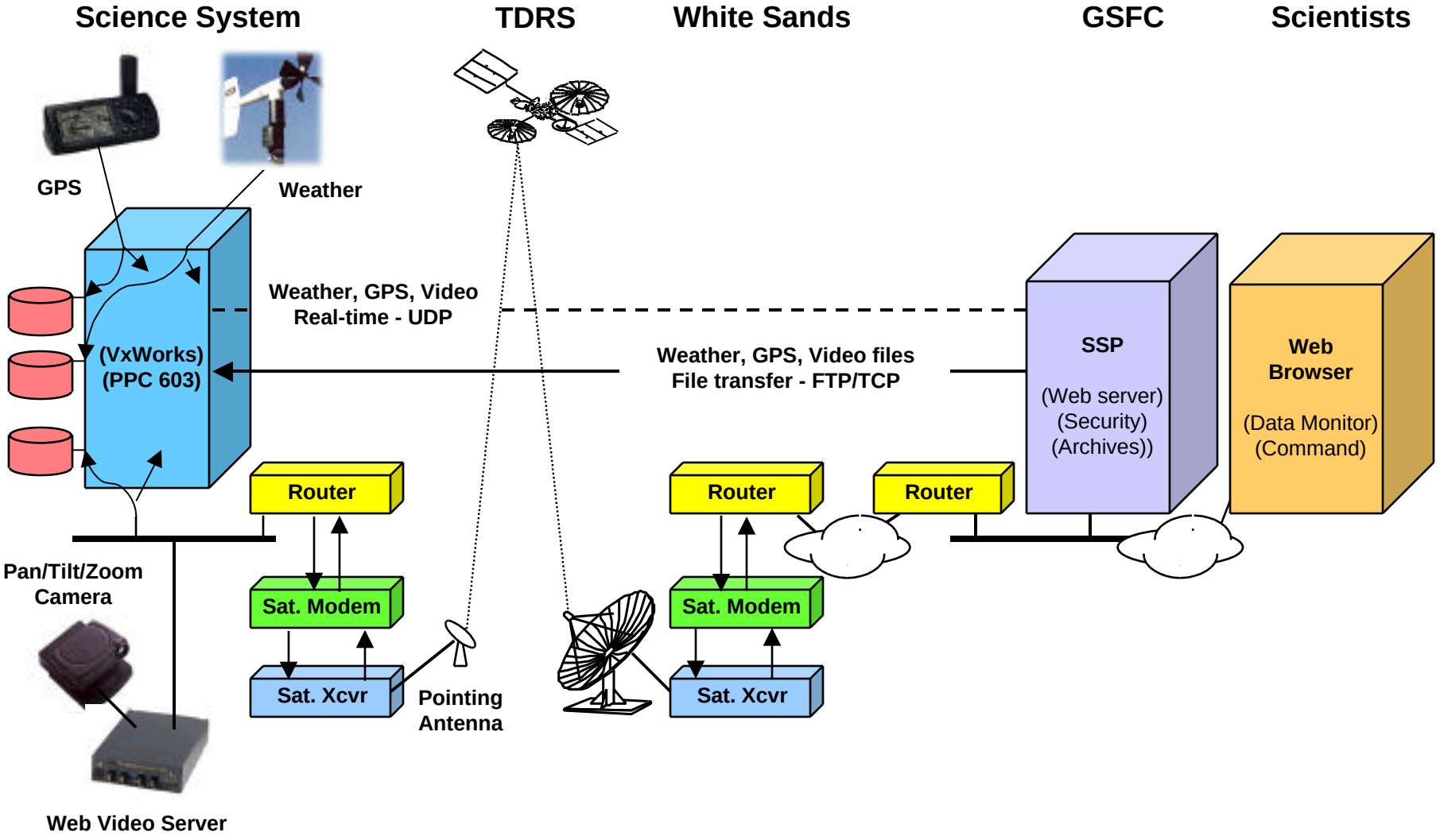
# Overview

- **Jan 1998-Jan 1999 - Proof-of-Concept prototype for a mobile spacecraft that demonstrates IP communication through an ADTECH channel simulator.**
- **Feb-Apr 1999 - Build on SPTR modifications in WSC to perform satellite-like operational demonstrations of IP communication through TDRSS to mobile spacecraft simulator (OMNI van)**
- **August 11,1999 - Webcast total solar eclipse worldwide from a ship in the Black Sea via TDRSS**
- **Nov. 1999 - Demonstrations of data, images, voice, email, streaming video through TDRSS to booth in JSC Mission Control for Inspection Day 1999**

# End-to-End IP Communication Prototype



# OMNI Van Applications

- **OMNI weather, GPS, images**
  - Real-time data sent by UDP/IP
  - Playback data sent by FTP/TCP/IP
- **Blind commanding using UDP/IP**
- **HTTP access to camera server for configuration and commanding**
- **Telnet from Lab to the prototype spacecraft**
  - Upload and run new software
  - Reliable commanding
- **NFS file transfer from prototype spacecraft**
- **FTP transfer starting on one TDRSS link and finishing on another**
- **Secure VPN link from OMNI Van to Lab**
- **TDRSS links using 2-way SSA, 2-way MA, and return-only MA**

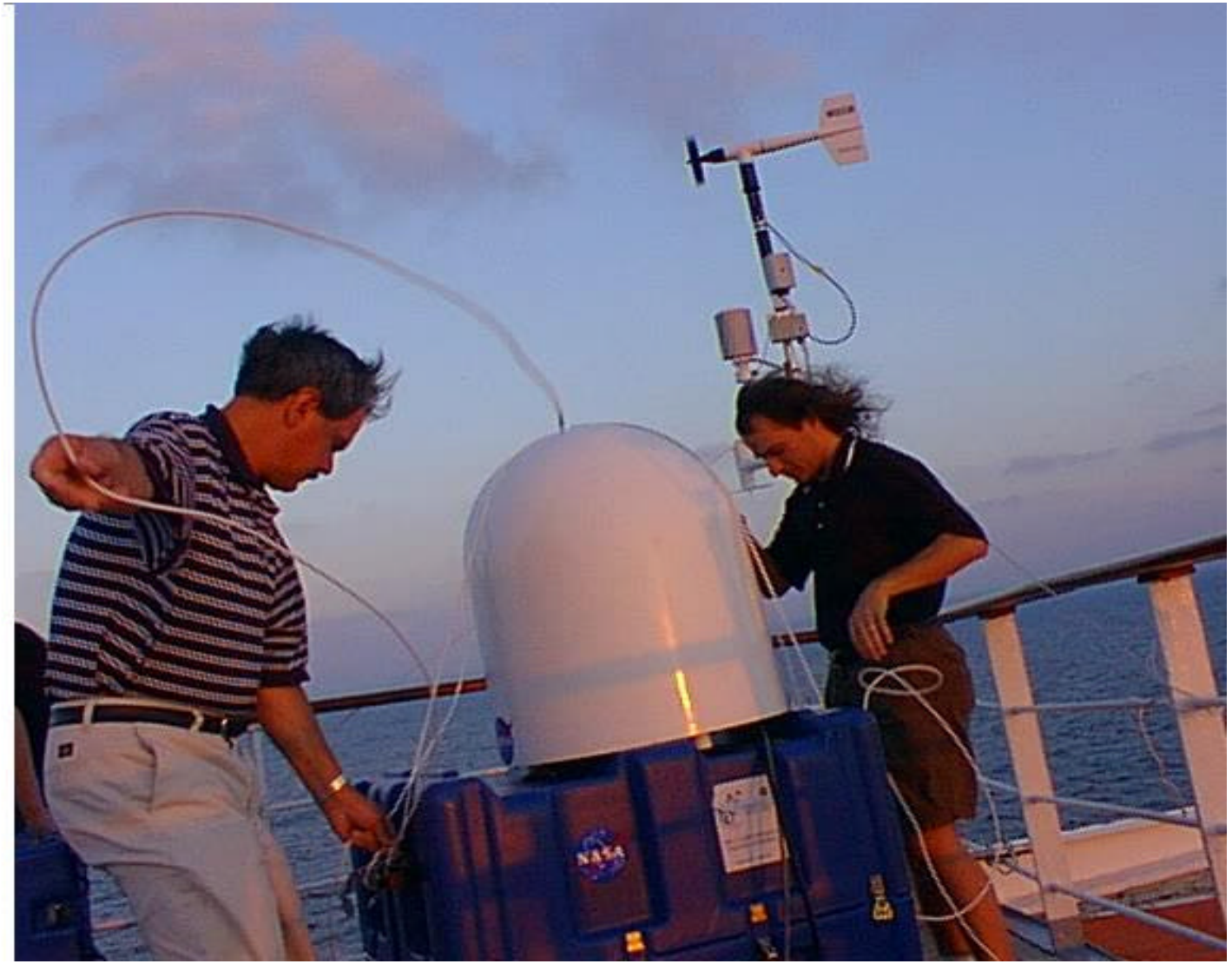
# IP Demo Prototype In Real Life

# The Eclipse 99 Project

# Eclipse 99 Applications

- OMNI weather, GPS, images
- Web browser on ship used to check weather forecasts and the OMNI web site
- Iphone used for Voice over IP audio conversations between GSFC and the ship
- AOL Instant Messenger from ship to participating museums
- Email from ship to anywhere
- Telnet from ship to anywhere
- RealVideo from ship to Ames server for streaming video

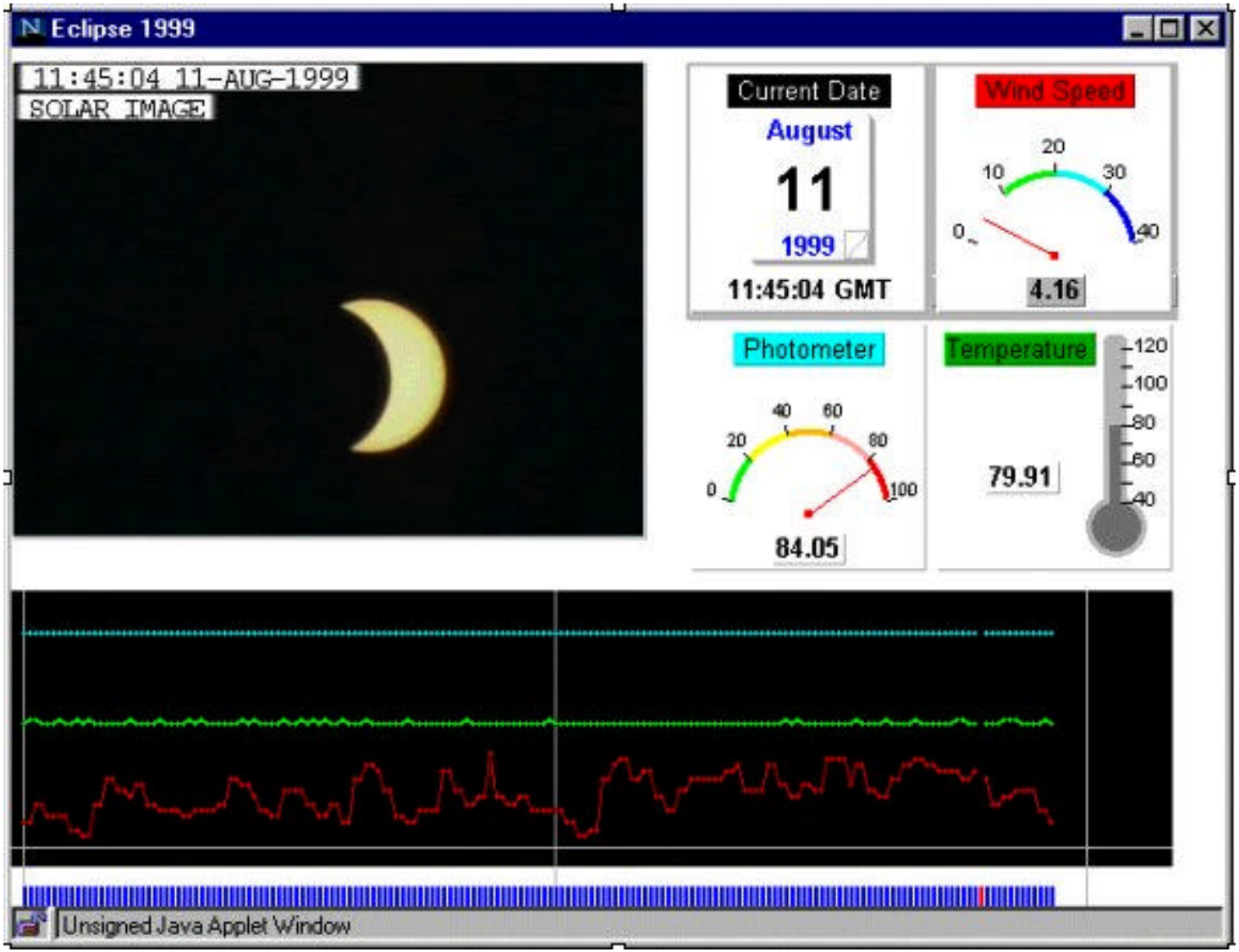
# Setting Up



# Command Center

# GPS Data Display Applet

# Eclipse Display Applet



# The Diamond Ring

# Eclipse Day Events!

"Remote scientists" at
the Maryland Science Center

"Flight Crew" on-board the ship

"Flight Control Team" at GSFC

**Participating Museums**

- Air and Space Museum
- Maryland Science Center
- Exploratorium
- Lawrence Hall of Science
- Coca Cola Space Science Center
- St. Louis Science Center
- Rochester Museum of Science
- Denver Museum of Natural History
- Science Center of West Virginia

**Web Activity**

- 7.5M hits Eclipse day
- .5M hits at Eclipse hour
- > 2000 Data/image streams

# Inspection Day '99 Applications

- OMNI weather, GPS, images
- Audio/Video Tours of Goddard
- Downloaded demo copy of Iphone using web browser in van via TDRSS
- Iphone used for Voice over IP audio conversations between GSFC and JSC
- Email from van to anywhere
- Telnet from van to OMNI web server to edit web pages
- RealVideo from van to GSFC for streaming video

# ID '99 - JSC Mission Control Center

# Summary

- Internet Protocols worked over a geosynchronous link
- UDP/IP worked for return-only one-way links, which are identical to those used by current spacecraft
- Internet protocols operated over the same RF links as current TDM and CCSDS protocols
- Tested wide variety of UDP/IP and TCP/IP applications with no additional TDRSS/WSC modifications needed
- Implemented our systems with standard COTS network equipment and software

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